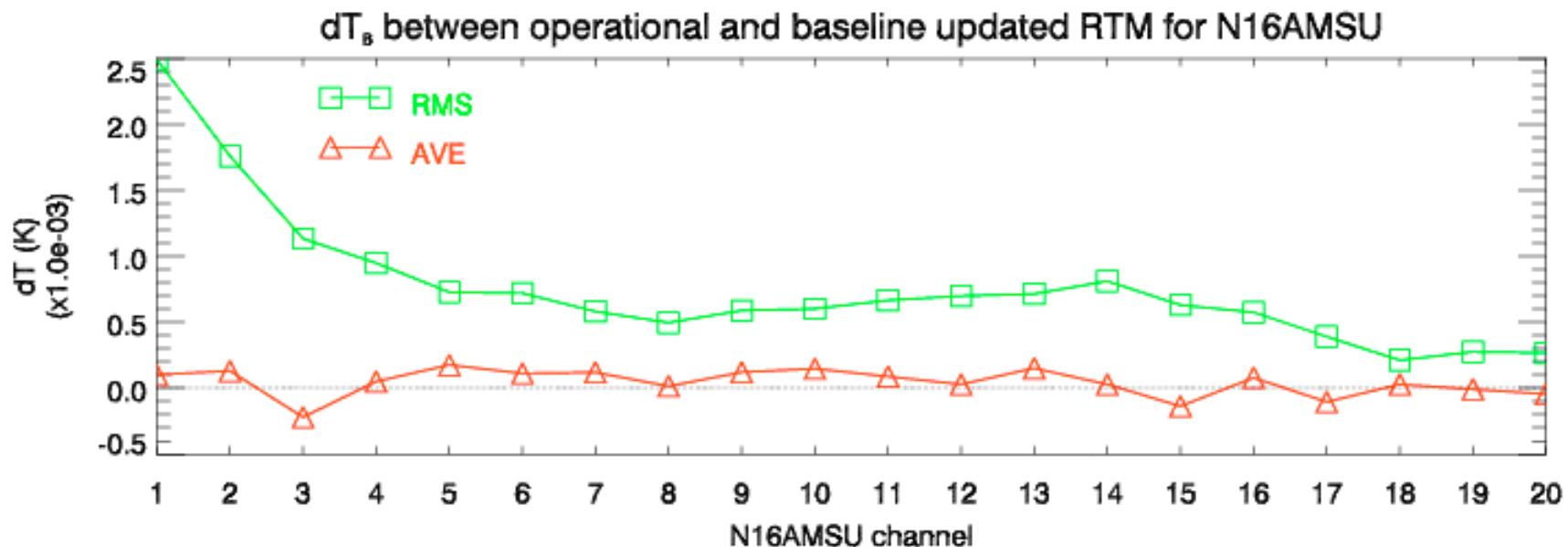
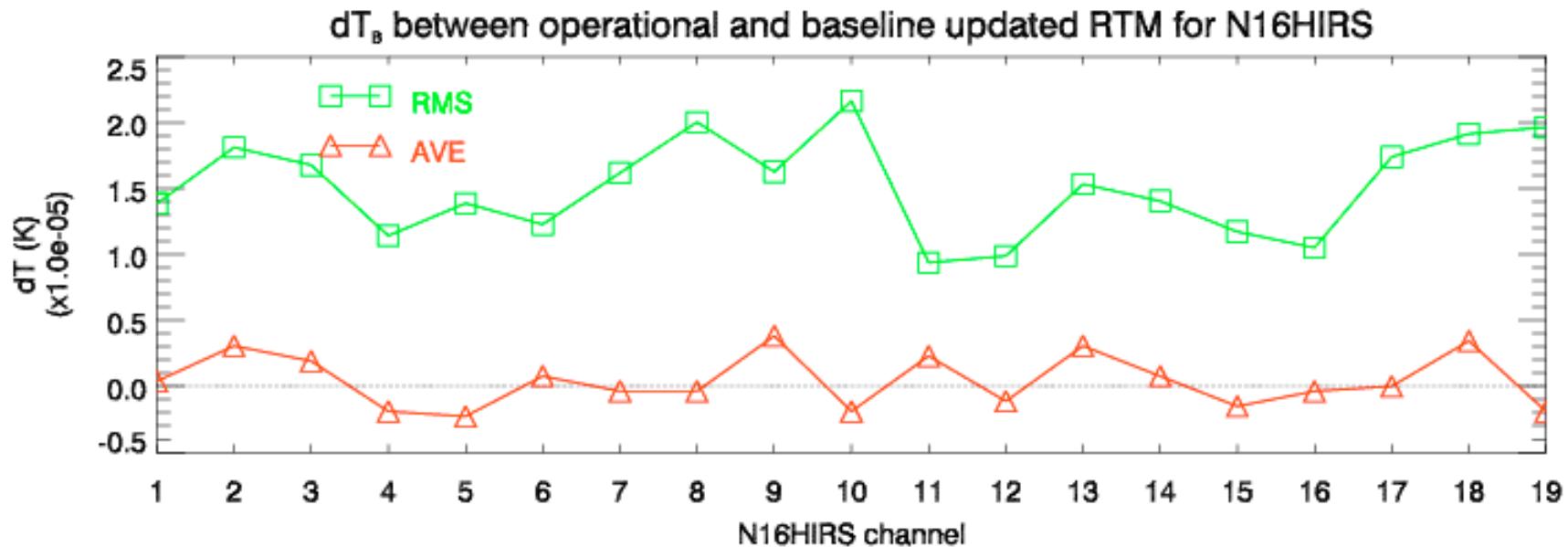


# NCEP Radiative Transfer Model Status

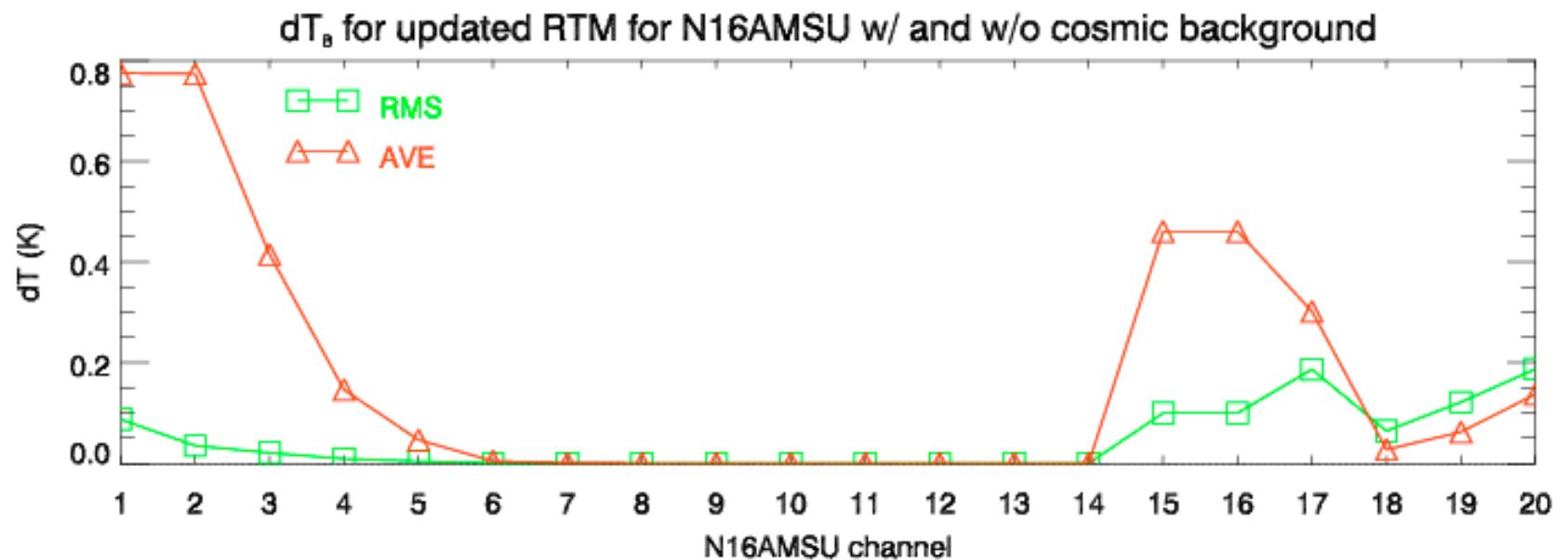
Paul van Delst

# Comparison of Operational and Updated RTM

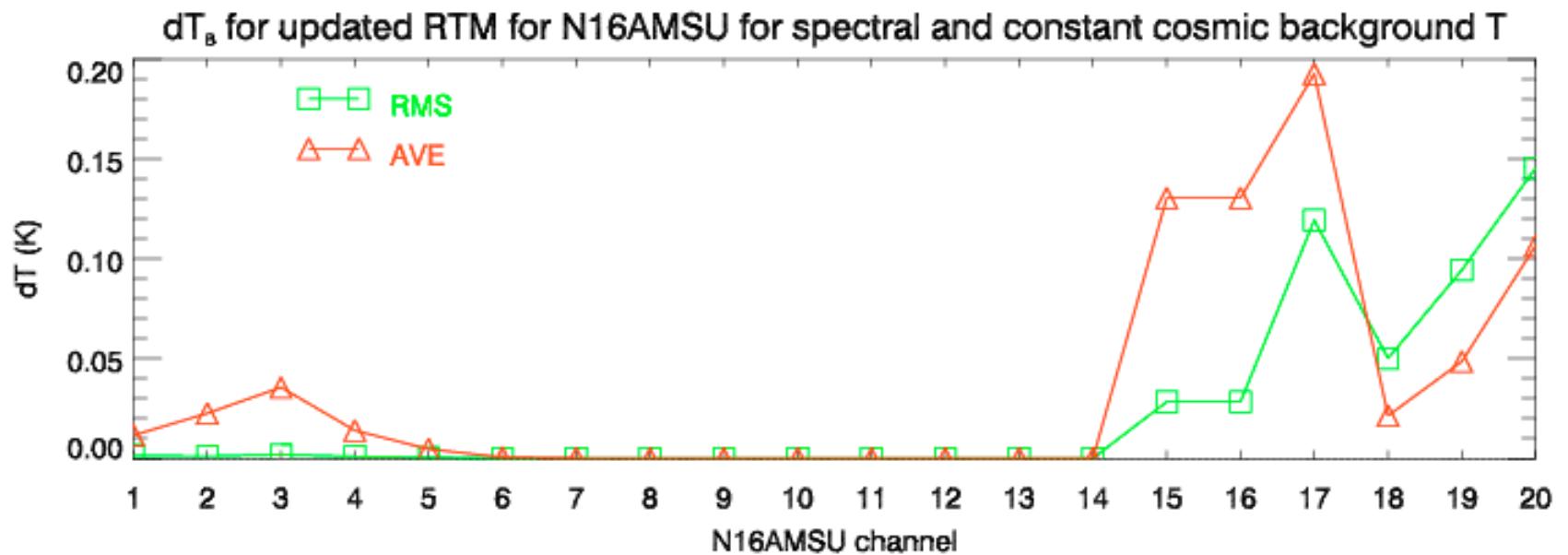


# MW Cosmic Background

$$T_{bc} = \frac{h\nu}{2k} \frac{\left(\exp(h\nu/kT) + 1\right)}{\left(\exp(h\nu/kT) - 1\right)}$$

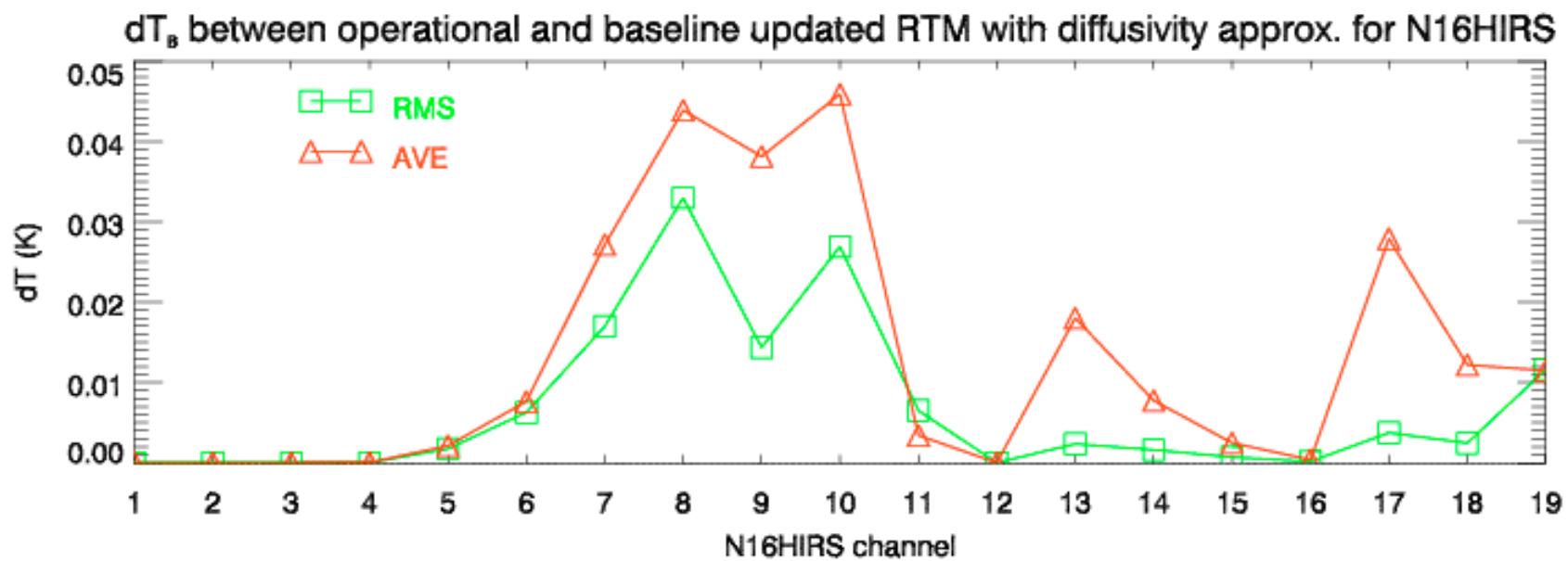


# MW Cosmic Background Difference between Spectral and Constant $T_{bc}$

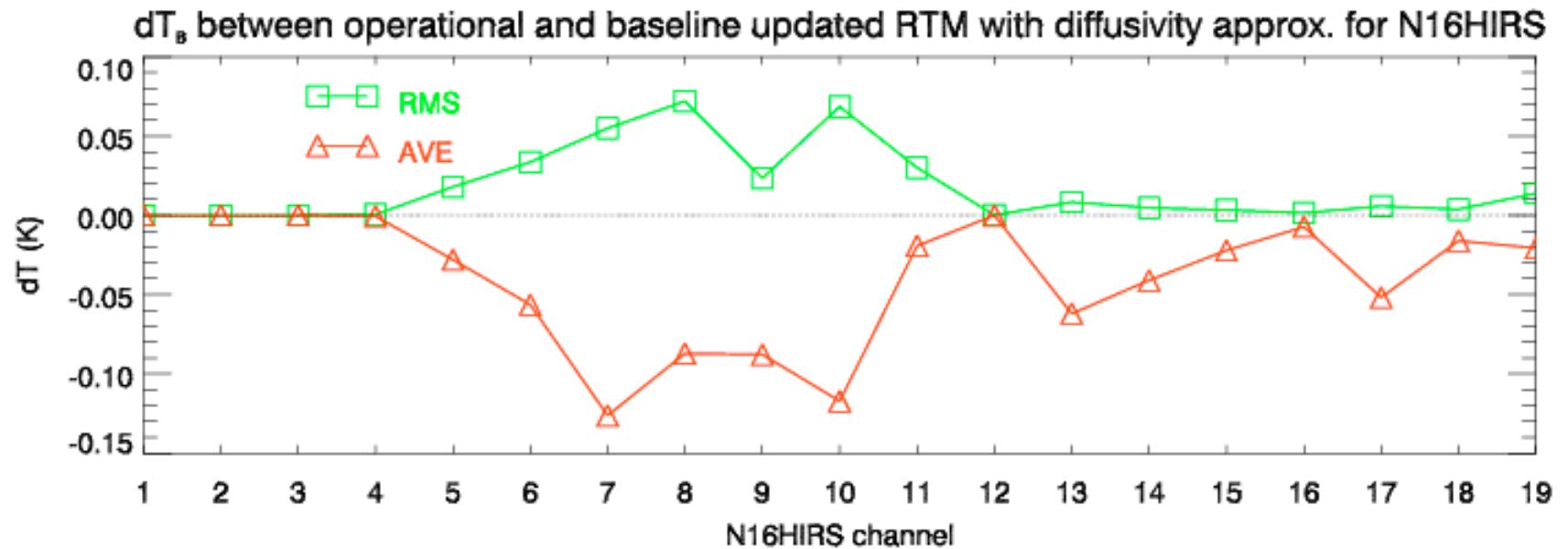


# IR Downwelling Thermal Specular Reflectivity

Currently, downwelling IR transmittance calculated at a single angle ( $\sim 53.13^\circ$ , i.e.  $\sec\theta=1.66$ ) for every layer.

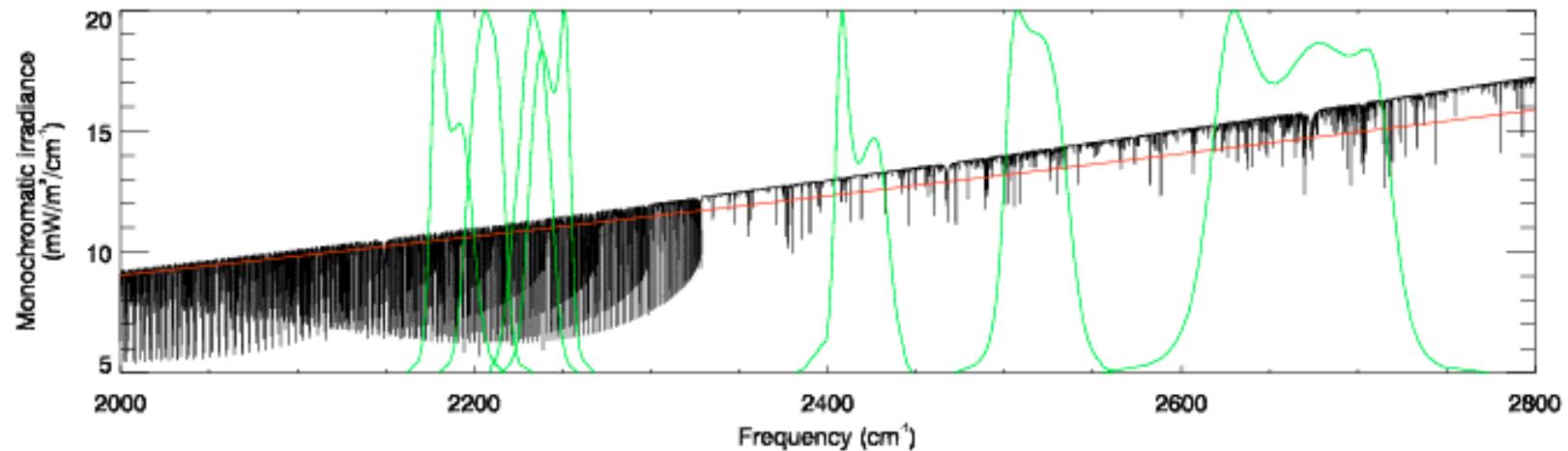


# IR Downwelling Thermal Isotropic Reflectivity

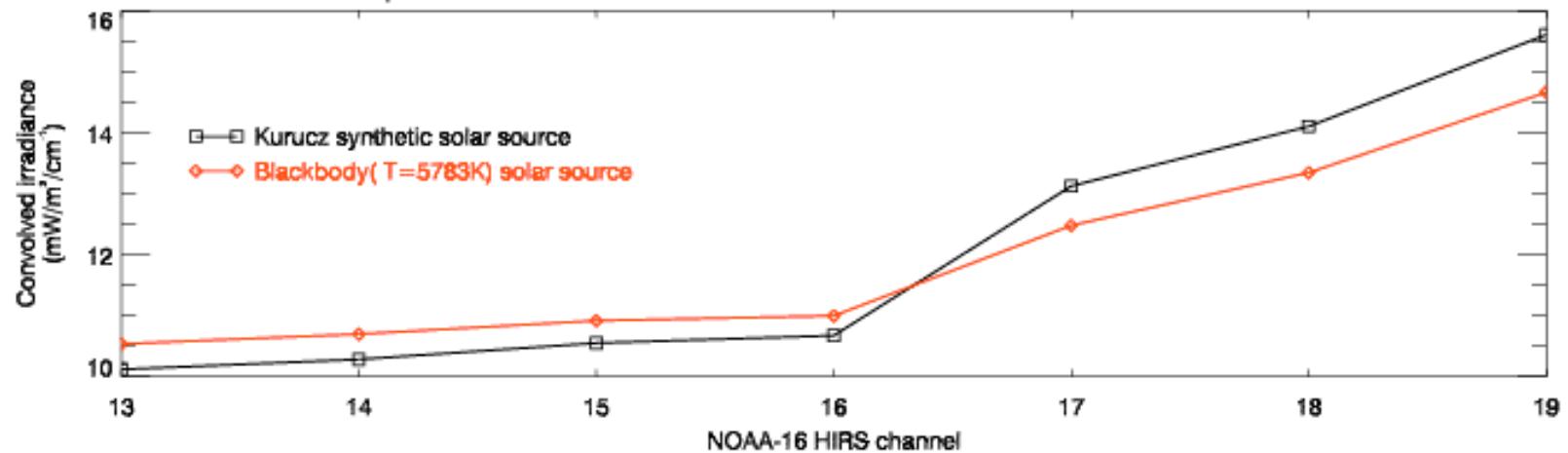


# Solar Source Functions

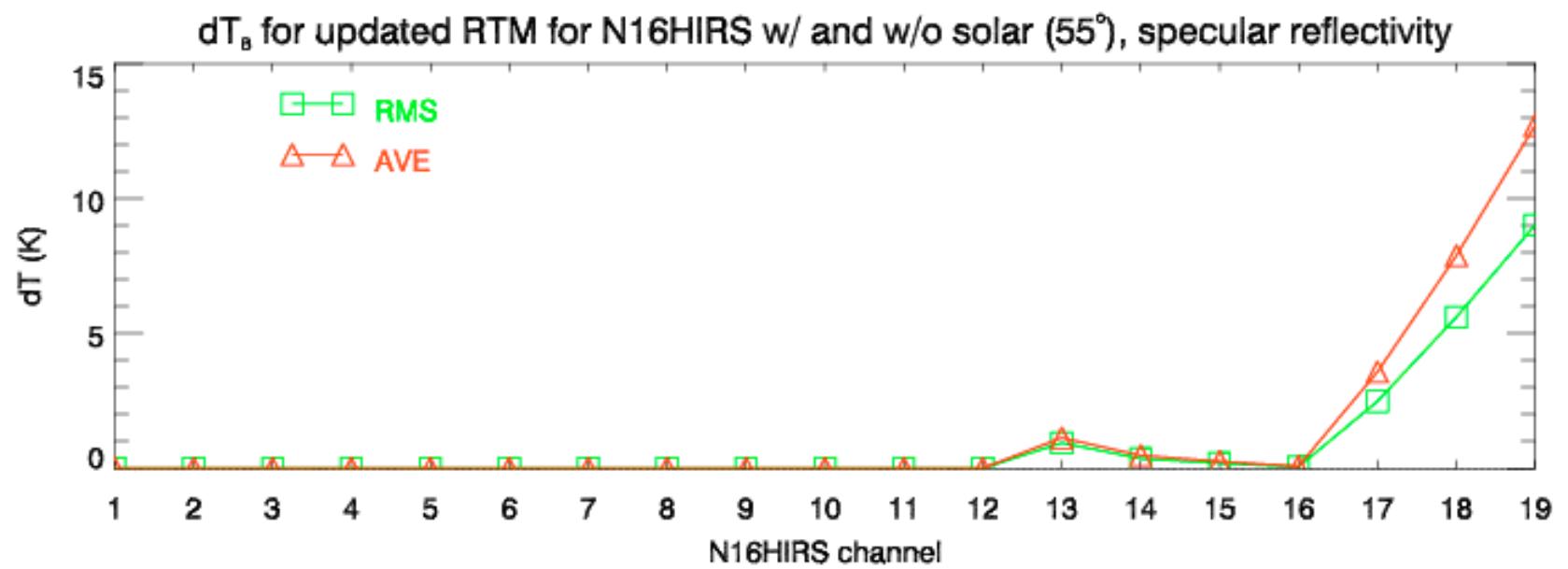
Comparison of synthetic solar and blackbody ( $T=5783K$ ) spectra  
and NOAA-16 HIRS ch.13-19 SRFs



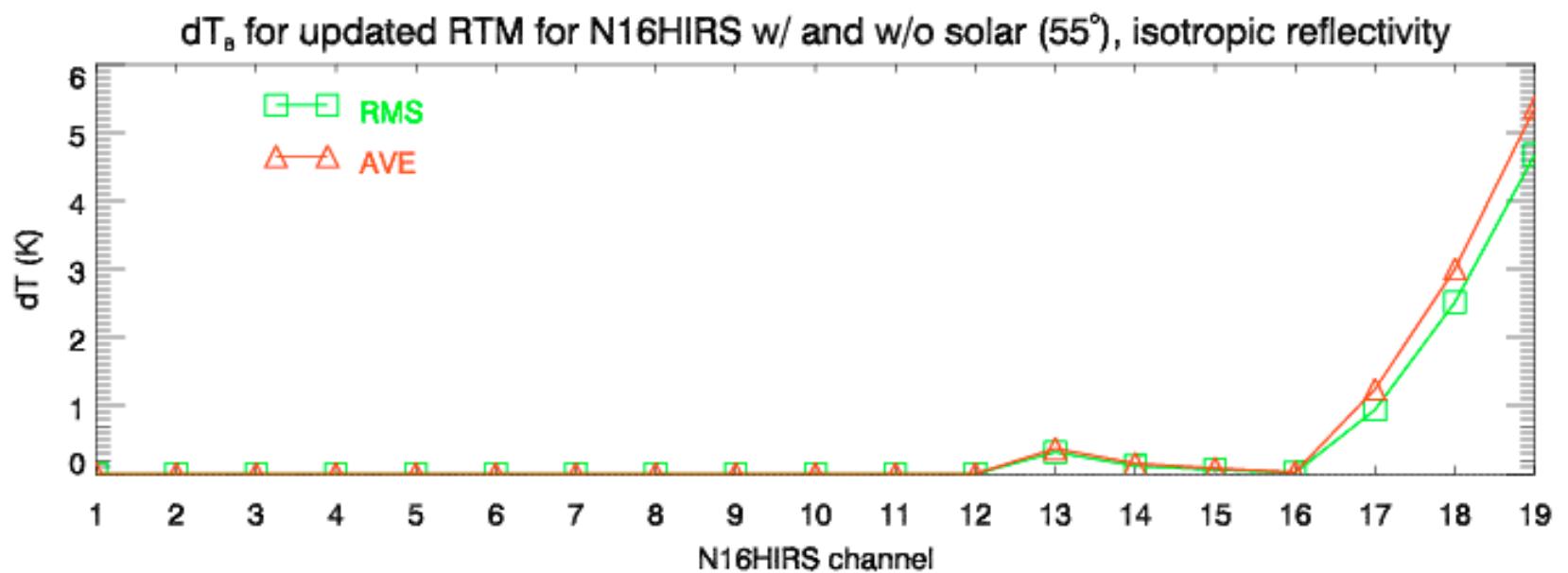
Comparison of convolved solar source functions for NOAA-16 HIRS ch.13-19



# IR Direct Solar Specular Reflectivity



# IR Direct Solar Isotropic Reflectivity



# Tangent-linear Model

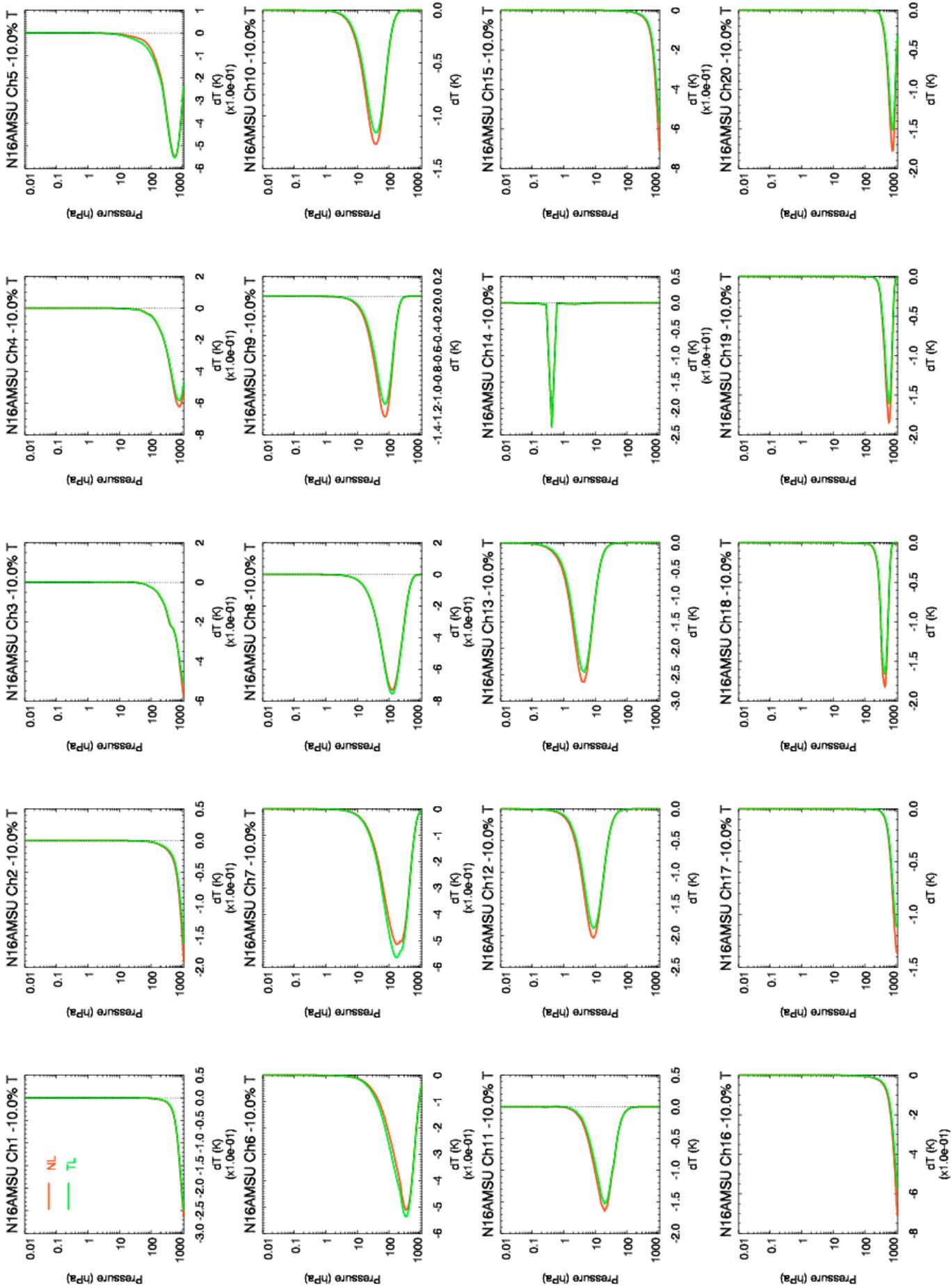
For a forward model:

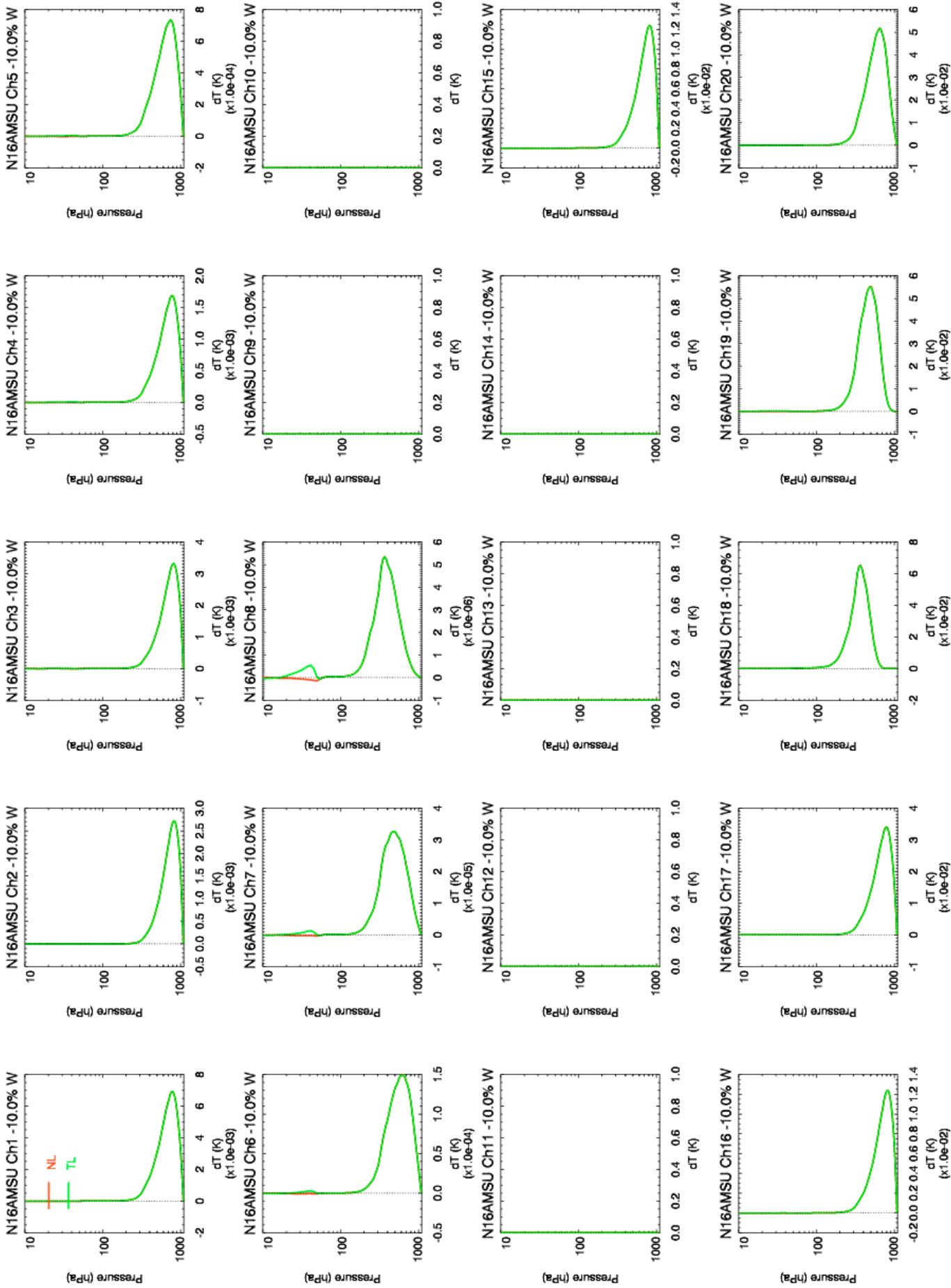
$$R = f(p, T, w, A), \quad A = g(p, w, o)$$

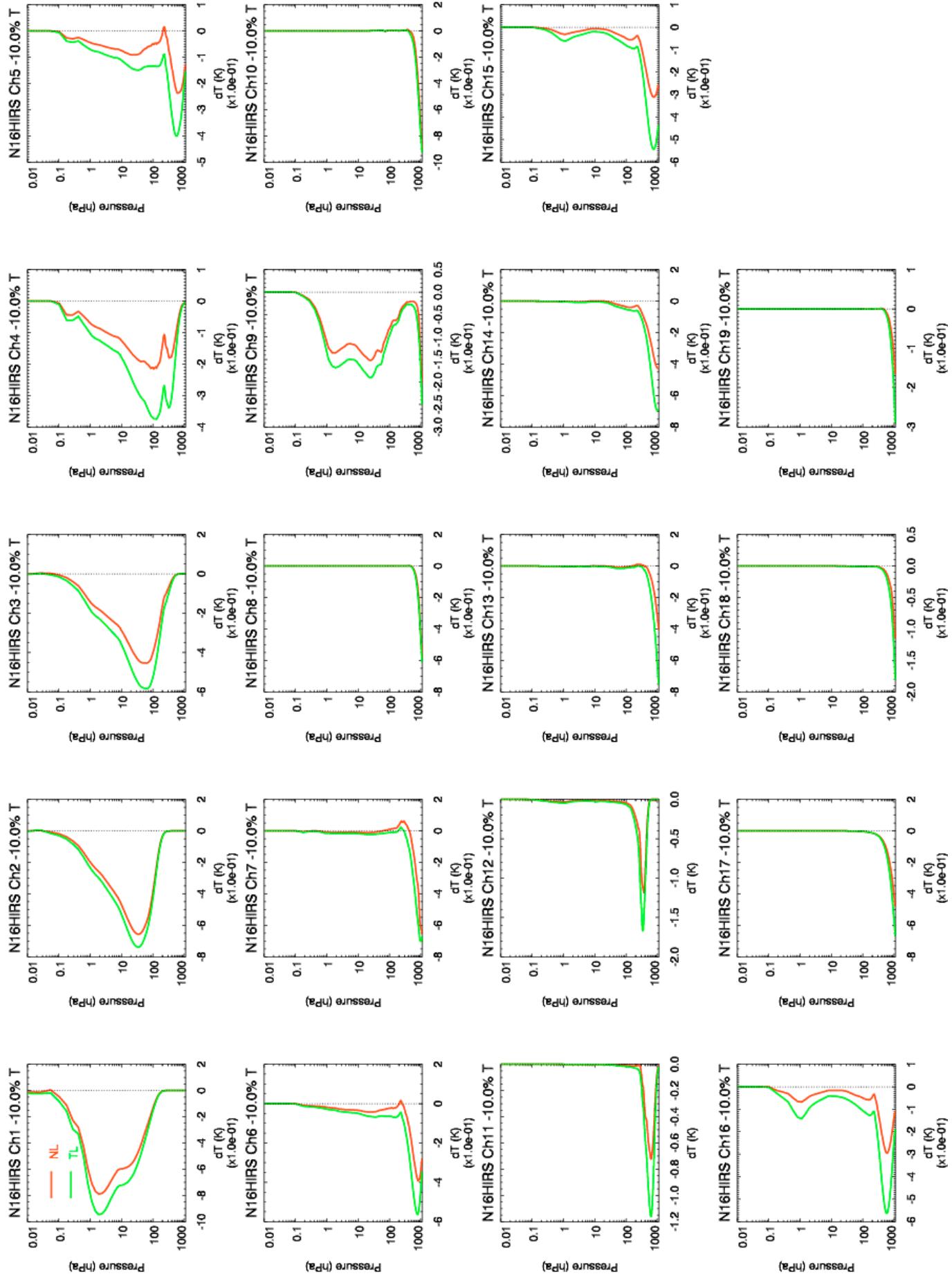
Derive the tangent-linear form:

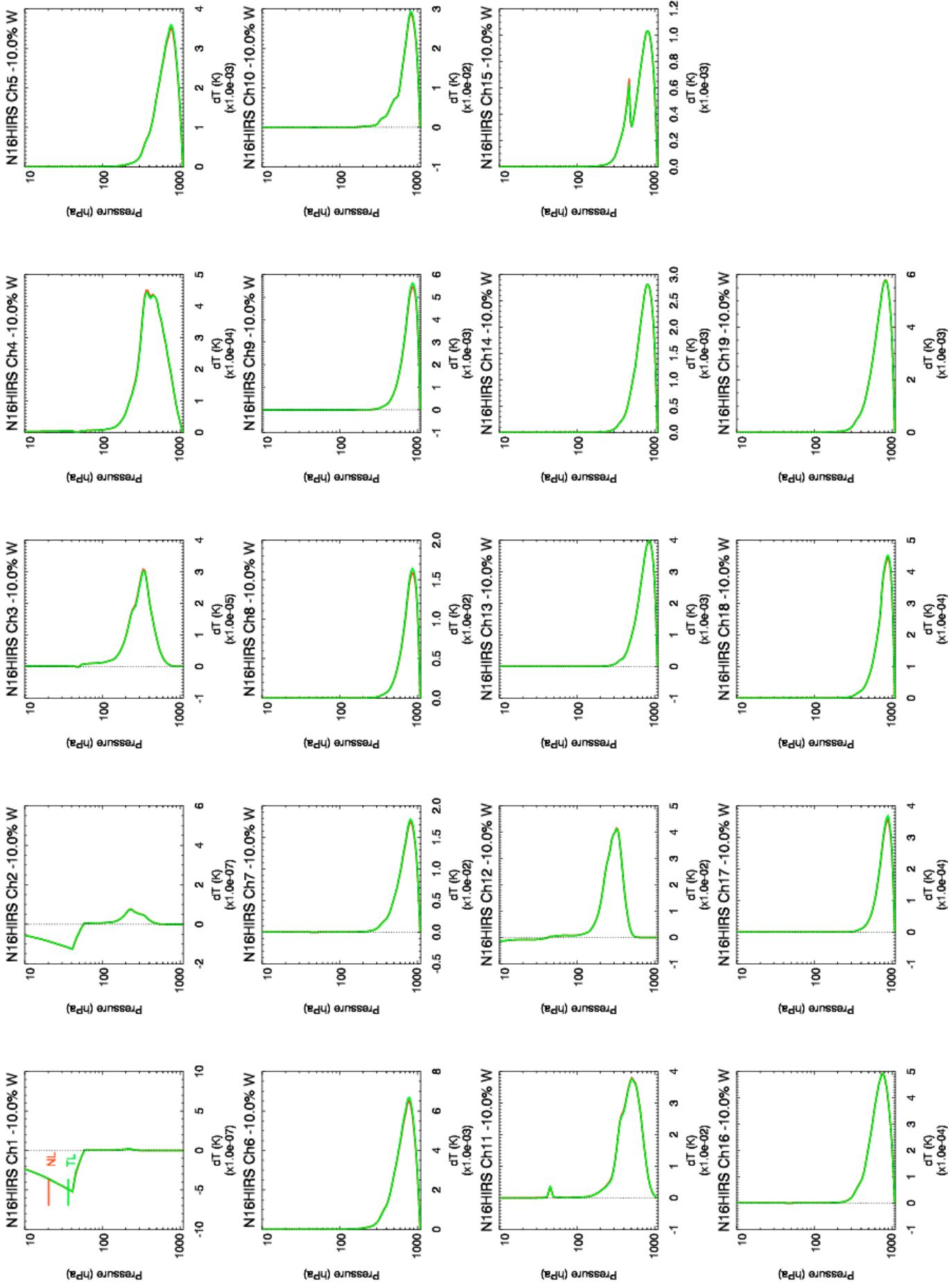
$$\delta R = \frac{\partial f}{\partial p} \delta p + \frac{\partial f}{\partial T} \delta T + \frac{\partial f}{\partial w} \delta w + \frac{\partial f}{\partial A} \delta A$$

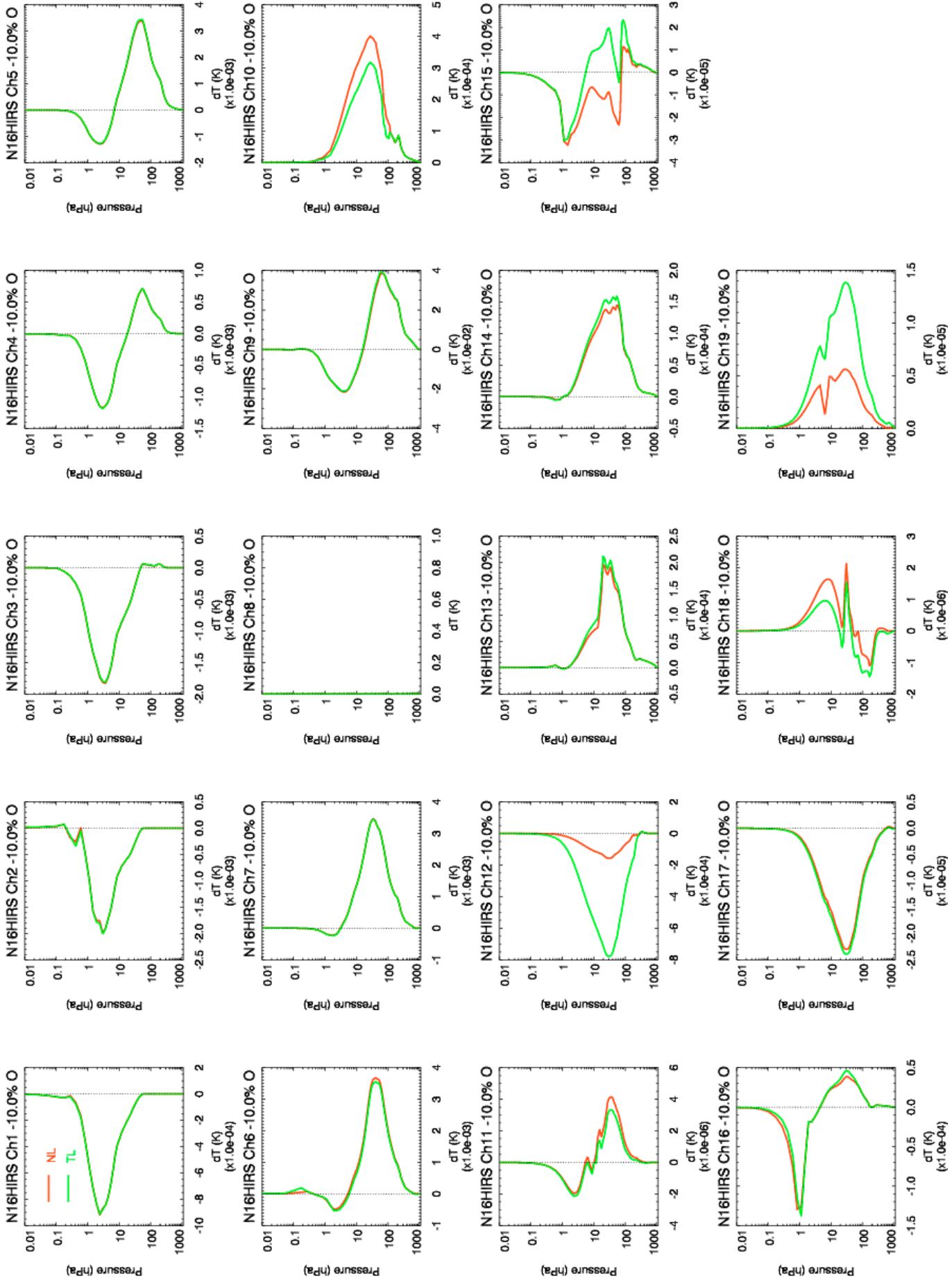
for each component.











## Adjoint Model

Given the tangent-linear form:

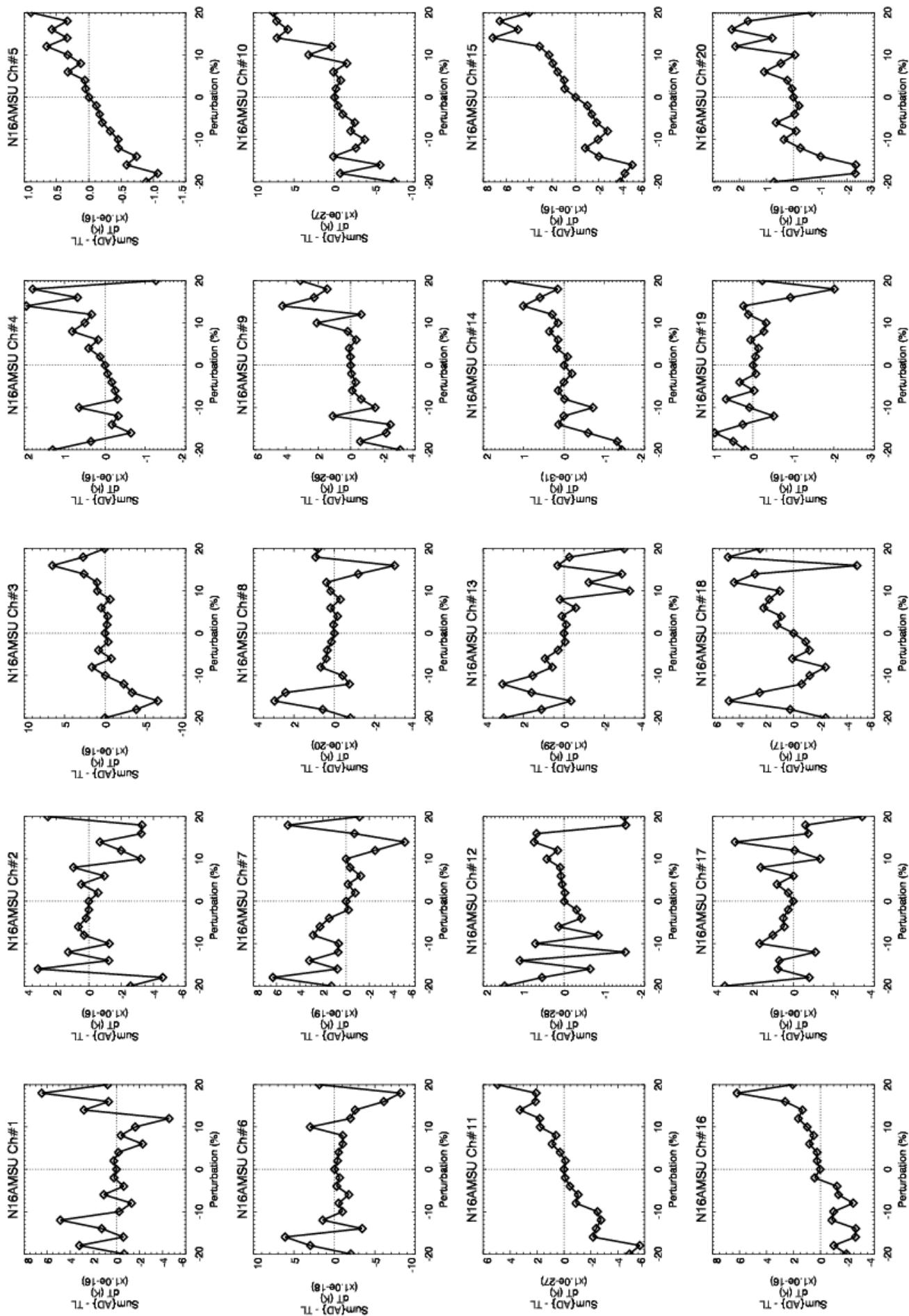
$$\delta R = \frac{\partial f}{\partial p} \delta p + \frac{\partial f}{\partial T} \delta T + \frac{\partial f}{\partial w} \delta w + \frac{\partial f}{\partial A} \delta A$$

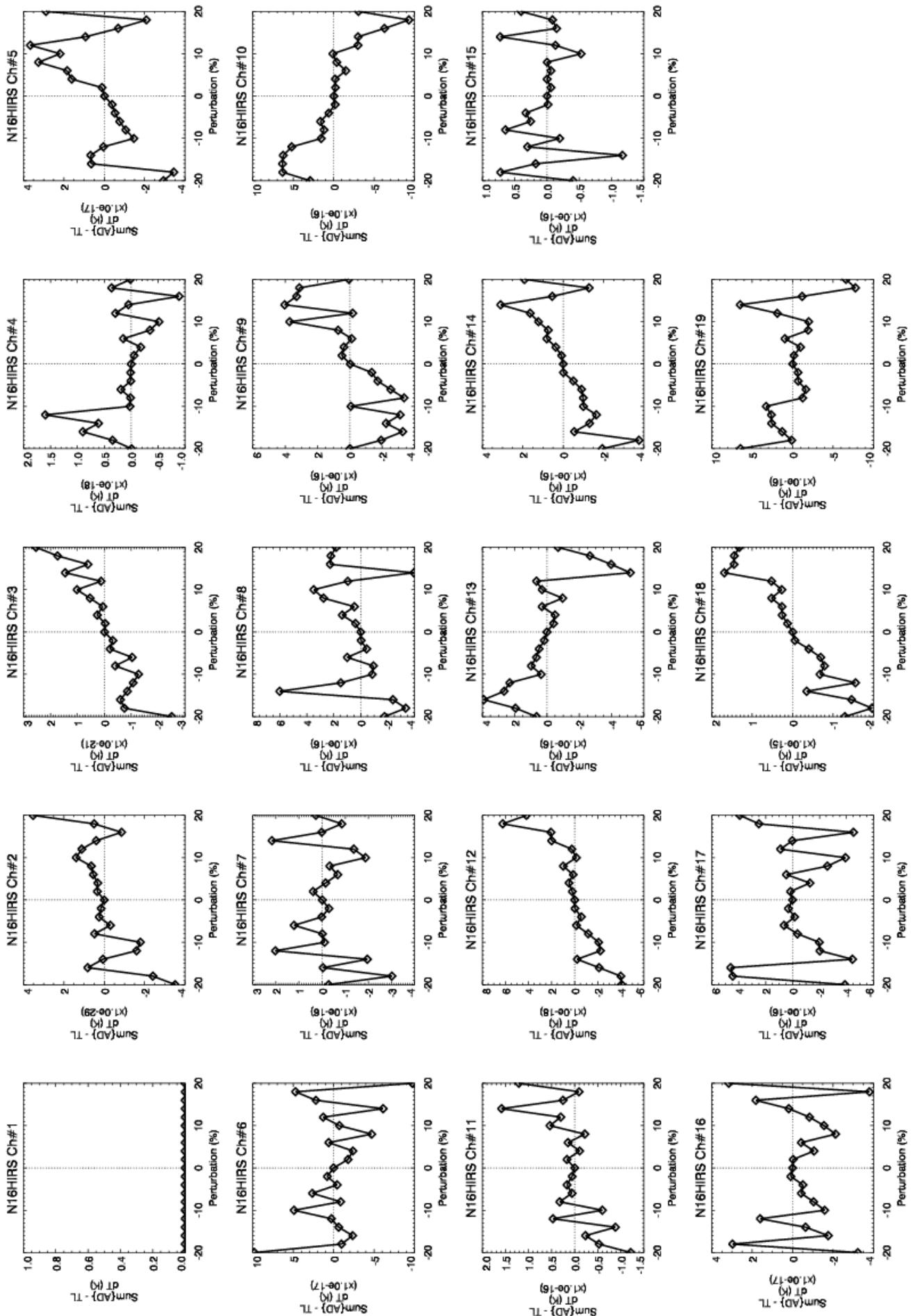
The adjoints are given by the transpose of the TL model:

$$\delta^* p = \frac{\partial f}{\partial p} \delta^* R$$

etc..

$$\delta^* T = \frac{\partial f}{\partial T} \delta^* R$$

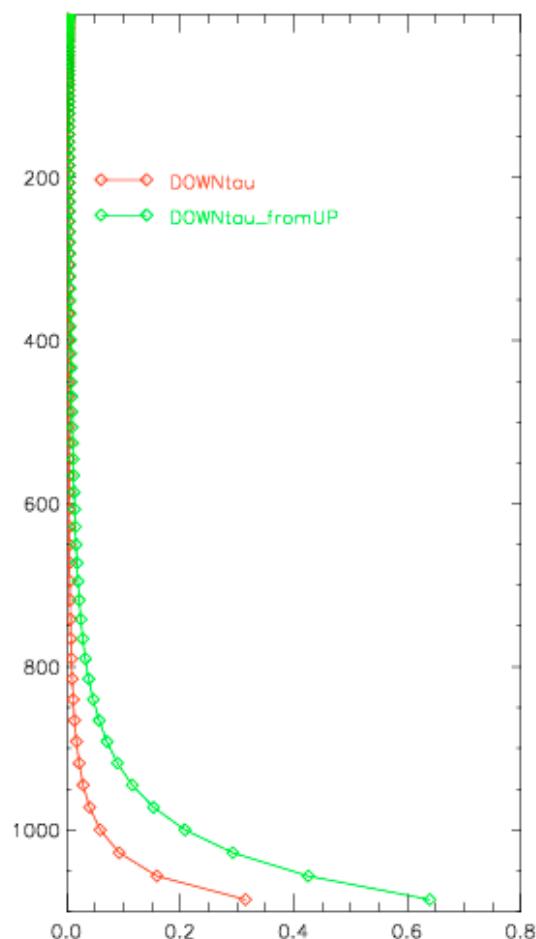




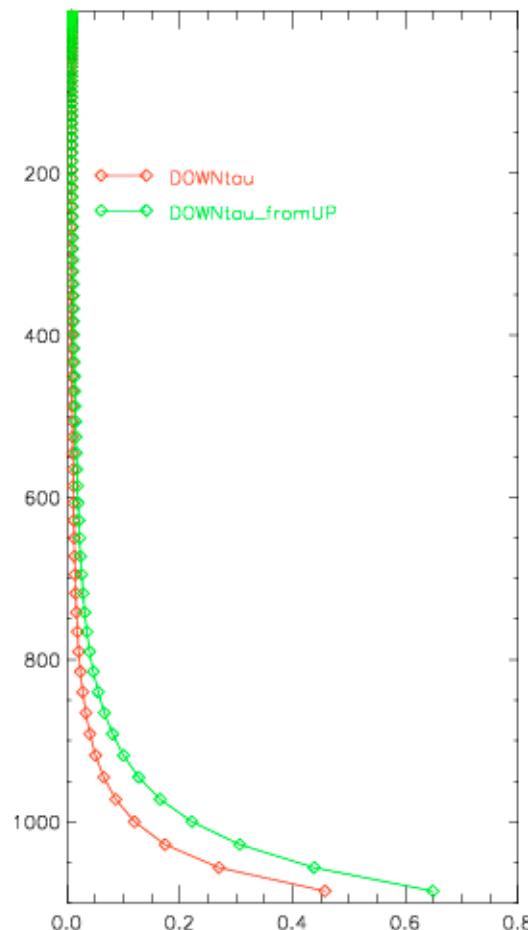
## To Do #1...

Calculate the downwelling transmittance correctly for the polychromatic case.

HIRS ch5



HIRS ch6



## To Do #2...

- Complete unit testing of Adjoint Model.
- Generate K-matrix (Jacobian) Model.
- Code optimisation.
- T. Kleespies has generated the OPTRAN transmittance model coefficients for AIRS (May 16). Incorporate these into RTM.
- Reformulate predictors and regression scheme for layer rather than level input.
- Get convolved transmittances for other satellites from Larrabee.